DOCUMENT RESUME

ED 219 234 SE 038 269

AUTHOR	Sparrow, Mary E.; And Others
TITLE	Fishy Activities for Your Small Fry. A Unit Plan in Fish Biology for Grades Kindergarten through Sixth. Educational Series Number 28.
INSTITUTION	Virginia Inst. of Marine Science, Gloucester Point, Va.
SPONS AGENCY	National Oceanic and Atmospheric Administration (DOC), Rockville, Md. National Sea Grant Program.
PUB DATE	[82]
GRANT	NA-80AA-D-00021
NOTE	42p.
AVAILABLE FROM	Sea Grant Marine Advisory Services, Marine Education Center, Virginia Institute of Marine Science, Gloucester Point, VA 23062 ($2.00).
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Biological Sciences; Elementary Education; *Elementary School Science; Environmental Education; *Ichthyology; *Learning Activities; Marine Biology; *Science Activities; Science Curriculum; Science Education; Teaching Guides; Units of Study
IDENTIFIERS	*Marine Education

ABSTRACT

This unit in fish biology is suitable for kindergarten through sixth grade. Provided in the unit are: (1) behavioral objectives for grades K-3 and 4-6; (2) an overview of activities and instructional strategies; (3) background information on fishes; (4) diagrams of internal/external fish structure; (5) list of key vocabulary words; (6) discussion of skill building (observing and inferring); (7) 4 worksheets for grades 4-6; (8) description of 22 supplementary activities; (9) seek-and-find puzzle; (10) crossword puzzles (one for grades 2-3 and one for grades 4-6); (11) post-tests for grades 2-3 and 4-6; (12) sources and materials (student references and teacher references/references used in preparing this packet, including publications, audio-visual materials, aquarium equipment suppliers, marine life suppliers, and local resources such as seafood restaurants, local fishermen, and bait/tackle shops); and (13) answers to seek-and-find puzzle, crossword puzzles, and post-tests. (JN)

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Fishy Activities for Your Small Fry

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a unit plan in fish biology for kindergarten through sixth grades

Virginia Sea Grant Program
College of William and Mary
Gloucester Point, Virginia

FISHY ACTIVITIES
FOR YOUR
SMALL FRY

a unit plan in fish biology

for grades

kindergarten through sixth

Mary E. Sparrow

Frances L. Lawrence

Virginia Institute of Marine Science

Sea Grant Marine Advisory Services

Marine Education Program

School of Marine Science

and

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of

The College of William and Mary

Educational Series Number 28

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illustrated by Joe Gilley

Marine Education
VIMS SEA GRANT PROGRAM

Copies of this publication may be ordered for $2.00 each from:

Sea Grant Marine Advisory Services
Marine Education Center
Virginia Institute of Marine Science
Gloucester Point, VA 23062

Acknowledgments

For their review and constructive criticism, appreciation is expressed to *James A. Lanier,* Director of Educational Programs, New Jersey Marine Sciences Consortium (formerly at VIMS) and *Dr. William D. DuPaul,* Head, Department of Sea Grant Marine Advisory Services, Virginia Institute of Marine Science.

Appreciation is also expressed to *Ann Kelly* and *Lorene Childers,* Seaford Elementary School, Yorktown, Virginia, and *Larry McGraw,* Yorktown Elementary School, Yorktown, Virginia, for field testing and suggestions.

Thanks go to *Jean Ann Herndon,* VIMS-Sea Grant Marine Education Program and the personnel of the VIMS Report Center for preparing manuscript drafts and composing the final copy.

The authors also wish to note the value of the VIMS-Sea Grant Marine Education Materials System (MEMS) in the preparation of this publication.

This publication was supported by the National Sea Grant Program, National Oceanic and Atmospheric Administration, Department of Commerce, through grant number NA 80AA–D–00021 to the Virginia Institute of Marine Science, College of William and Mary.

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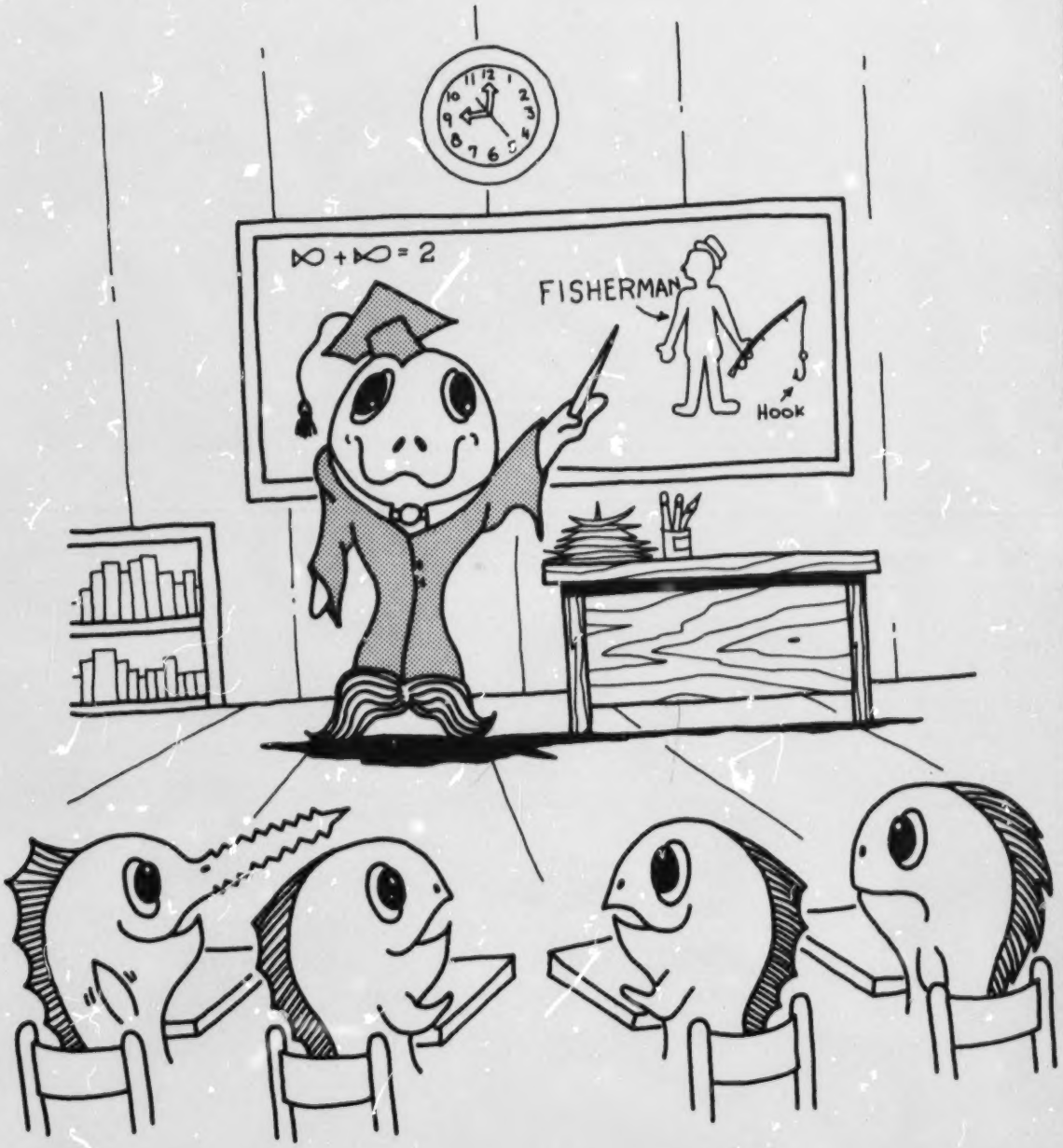

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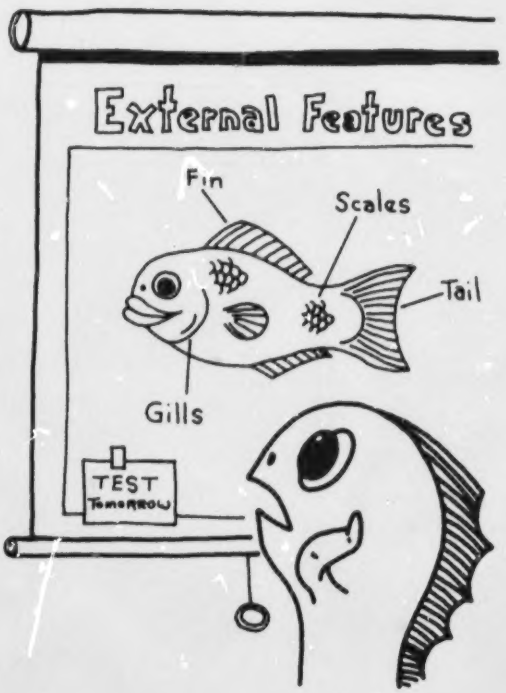
Objectives

Grade Level: K-6

This kit is a collection of fishy ideas for use in your classroom. The ideas in this kit are diverse in nature and complexity. Select and adapt objectives and activities to meet the interests, capabilities and grade level of your students.

Behavioral objectives. After successfully completing the key activities in this packet students will be able to:



Grades K-3

1. Identify the external features common to most fishes: gills, fins, tails, scales.
2. State the function of the external structures named (Grades 2-3).
3. List ways in which fishes are different from people. List how fishes are similar to people.
4. List ways fishes protect themselves.
5. Make observation (Grades K-3) and inference (Grade 3 only) statements about fishes.

Grades 4-6

1. Identify external features common to most fishes: scales, fins, lateral line, tail, gills, head, mouth.
2. Identify the swimbladder as an organ common to most fishes.
3. State the function of the external and internal structures named.
4. State ways in which fishes differ from each other, such as color, size, and protective abilities.
5. Make observation and inference statements about fish and distinguish between them.

Key Activities and Procedure

1. **Preparation** Review all materials in this packet. Obtain supplies necessary for the activities you select.

2. **Pretest** (One class period). Before beginning any instructional activities, have each of your students draw a fish. This drawing will come from the students' existing knowledge of fishes. Encourage detail. Have your students state, either orally or in writing, the function of the structures they have on their fishes. This activity will enable you to make a preliminary assessment of your students' knowledge of fishes.

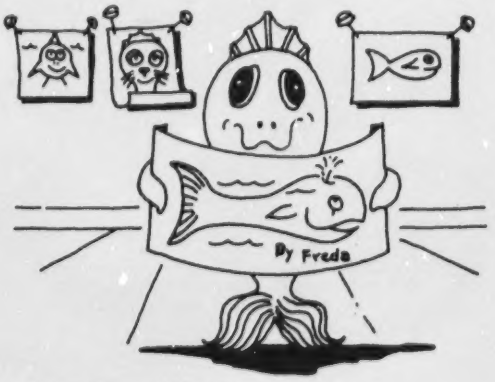
3. **Introductory activities** (One to three class periods). Select several activities from the "Supplementary Activities" list beginning on page 16.

4. **Audio-visual instructional materials** (Two to three class periods). The filmstrip "What is a Fish?"* may be used for grades K-3. "What is a Fish" comes in a kit, with worksheets and a test. When you are working with children whose reading skills do not allow them to use these printed materials easily, conduct activities orally. During the filmstrip, remember:

   - Point to the letters as the words are being spelled.
   - Point to the fishes' body parts and features as they are mentioned.
   - Use the worksheet and test orally, if your students' reading level so requires.

"The Shaping of Life"* (filmstrip, Cousteau Group, Inc.) may be used with the activities for grades 4-6. Have your students complete Worksheet I (page 12) if you use "The Shaping of Life," then discuss the following questions with your class. You will find reading "Background Information," pages 4 and 5, helpful prior to conducting the class discussion. Include the following questions in your class discussion.

1. The first (primitive) fishes were different from today's fishes. Why?
2. What is evolution? What causes it? When will it stop? Why?
3. What does the term "survival of the fittest" mean? What does it have to do with fishes having fins, tapered bodies, or strong jaws? Exactly what does "fittest" mean in this instance?
4. In terms of evolution, what did the model fish in the filmstrip show? In the history of the evolution of fishes what did the knife represent?



*This and other educational materials are available from:

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Watch for the following common errors in your students' responses.

- Discussing evolution as if the ancestral organisms had today's life forms in mind from the start, and changed themselves intentionally.
- Thinking of individual fish sensing the need to change and doing so.
- Thinking of changes as occurring in one large step in one generation as opposed to very small steps over many generations.

The crossword puzzles (pages 20 to 23) and the word search game (page 19) will reinforce vocabulary terms introduced in the filmstrip.

A list of other supplemental films and filmstrips is found on page 29.

5. **Observing fish** (Two to three class periods). Worksheets II, III, and IV (pages 13, 14 and 15) assist students in learning about fishes by making observations and inferences. If your students have not yet mastered these skills, be sure to use the skill building activities on pages 10 and 11 before beginning these worksheets.

6. **Gyotaku - Japanese Fish Printing** (One class period). Detailed instructions on fish printing are found in the leaflet accompanying this kit. Fish printing, by itself, is an interesting art activity. Combined with other activities in this packet, it serves as the highlight of a comprehensive learning experience which may reach into many disciplines.

7. **Supplementary activities** (Several class periods). Use of activities from this list (page 16) will enrich your lessons on fishes. Use as many as you feel are appropriate for your students.

8. **Summary and review** (One class period). Repeat the pretest activity. Do you see a change in your student's concept of fishes? Have them compare and discuss the two drawings.

9. **Post test** (One class period). Sample unit tests begin on page 24. Kindergarteners and most first graders will probably have to be tested orally. The test for grades K-3 requires that the teacher furnish an object for observation. We suggest a piece of fruit: it may be felt, looked at, smelled, and tasted.

Background Information

How fishes got that way

Many scientists infer that life on earth began in the sea billions of years ago. It is further inferred that microscopic marine life forms then EVOLVED (i-VOLVD) to become the ancestors of life on land and sea. Most of the major PHYLA (FIE-la) include land and water species.

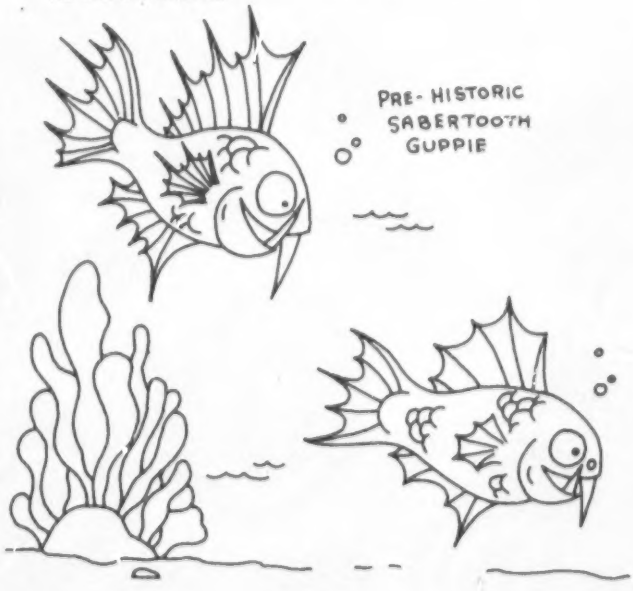
Through NATURAL SELECTION, sometimes called "SURVIVAL OF THE FITTEST", the life forms best ADAPTED to specific marine environments usually survived to reproduce abundantly in these environments. Other life forms that were not as well suited to their environments lived to produce fewer offspring, eventually becoming EXTINCT (ik-STINKT). Those life forms that survived continued to evolve by further adaptations into more complex forms including the first primitive FISHES. The lamprey that exists today is probably a direct descendant of a primitive fish. Lampreys have no jaws and use their suction mouths to feed from the sea floor or as parasites on other fishes.

Over many millions of years, natural selection has resulted in new species with body structures better adapted for various methods of feeding and locomotion. This evolutionary process has resulted in over 30,000 species of fishes. Species of various colors, sizes, and shapes inhabit most of earth's waters: salt and fresh, dark and light, shallow and deep, warm and cold.

Despite the many differences in fishes, there are striking similarities among them. They are all well adapted for life in the water. The shape of the fish's body offers little resistance to the flow of water over it. The blunt head is sufficiently pointed to penetrate the water and flows smoothly into the main trunk of the body. The thicker middle and the tapering towards the tail decreases turbulence and drag as the water flows by. FINS give fishes stability and steering capabilities.

All animals, including fishes, require oxygen. Fishes obtain this life-supporting gas through GILLS located directly behind and on the sides of the head. The red color of the gills comes from the myriad of capillaries which are close to the surface and transport oxygen-carrying blood. A hard outer covering, called the OPERCULUM (oh-PERK-yoo-lum), protects the gills.

Fishes have SENSORY ORGANS, some of which are similar to ours and some of which are very different. They have taste buds in their mouths (and in other places in some species), and their nostrils (not used for breathing) provide an excellent sense of smell. Most fishes are probably nearsighted and some cave dwelling and deep sea fishes have no eyes at all. Eyes and nostrils are present in a variety of sizes and shapes depending on the fish's adaptations to its environment.

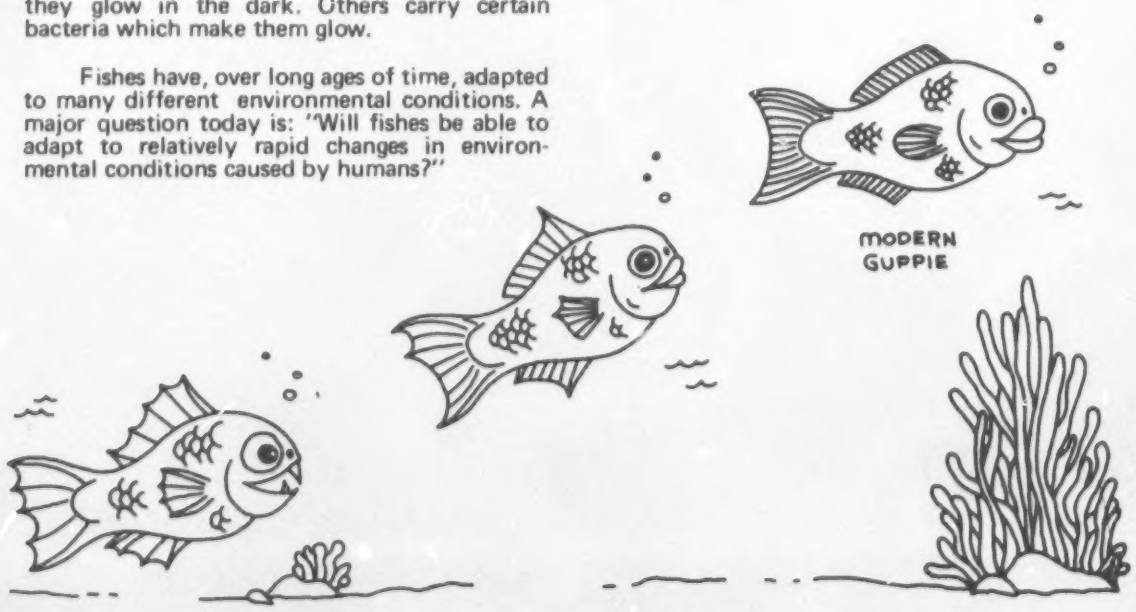


One particularly interesting sensory organ is the LATERAL (LAT-er-ul) LINE which is made up of indentations or pores located along the sides of fishes. This organ enables fishes to detect other moving fishes, animals, and objects from the disturbances created in the water by their movement. It is the lateral line which allows SCHOOLS of fish to change direction in unison.

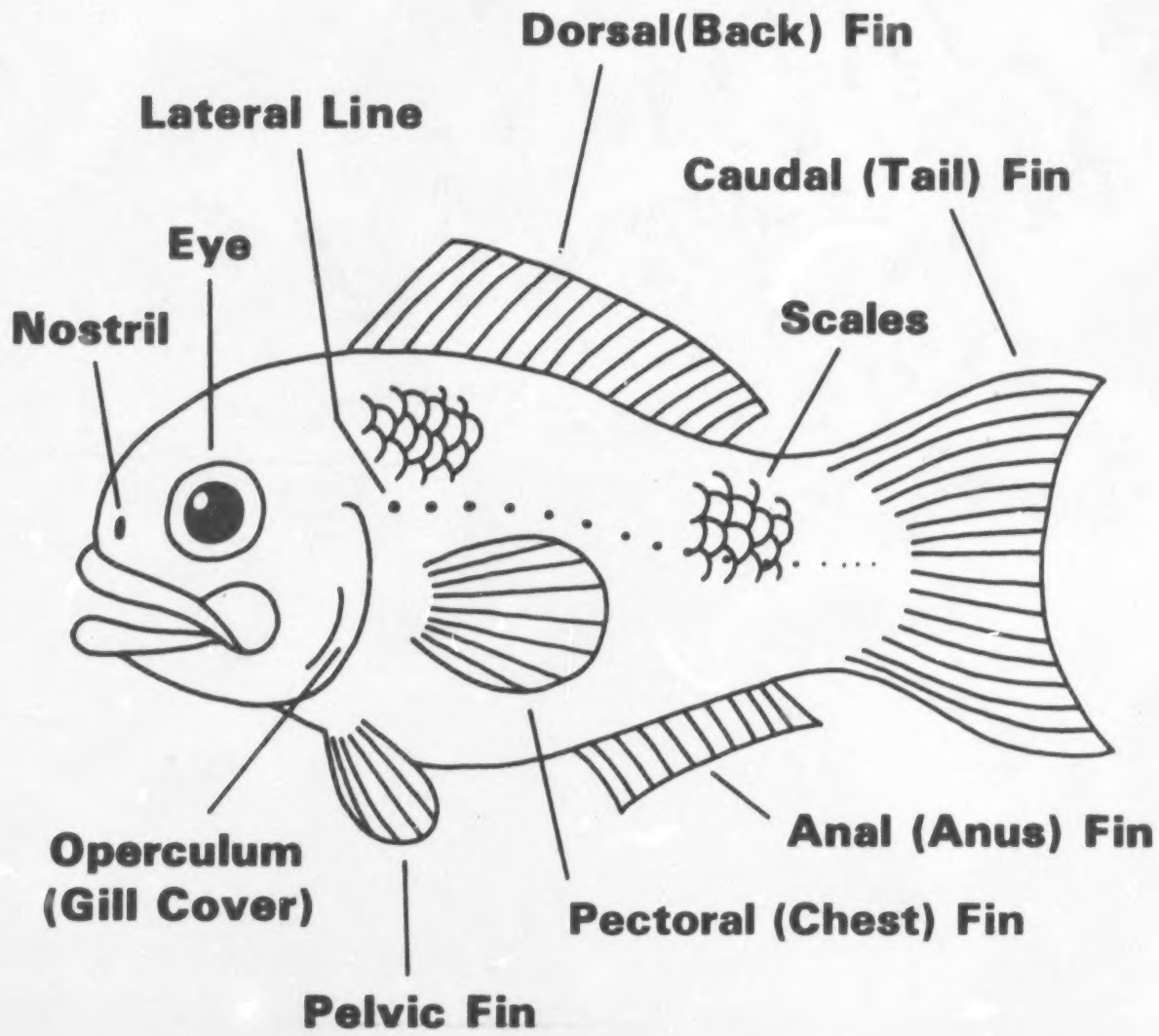
Through their evolution, most fish species developed SCALES as an external structure and the SWIM-BLADDER as an internal structure. Scales, along with a mucous coating, cover most modern fishes. The protective armor-like scales of primitive fishes have evolved into the thinner lighter scales of today's fishes. The swim-bladder, which adjusts the density of a fish's body to that of the water which surrounds it, is located in the middle of the body. This body organ allows fishes to swim without sinking or floating. For some sharks, the lack of this organ results in the need for almost constant motion to keep from sinking. These same sharks also lack the muscles to force water through their gills. If they are prevented from swimming, they may be asphyxiated as they sink.

Each species of fish is further adapted to its own HABITAT (HAB-i-tat) and NICHE (NITCH). Flat fishes, such as flounders, are bottom dwellers, with both eyes on one side of the head. They have special orientations of their gill, mouth, and other body parts. Some fishes have special coloration, and some can even change colors depending on the amount of light and the color of the environment. Some bio-luminescent (bye-oh-LUME-in-ESS-ent) fishes in the deep, dark ocean have the special ability of chemically producing light, like fireflies, and they glow in the dark. Others carry certain bacteria which make them glow.

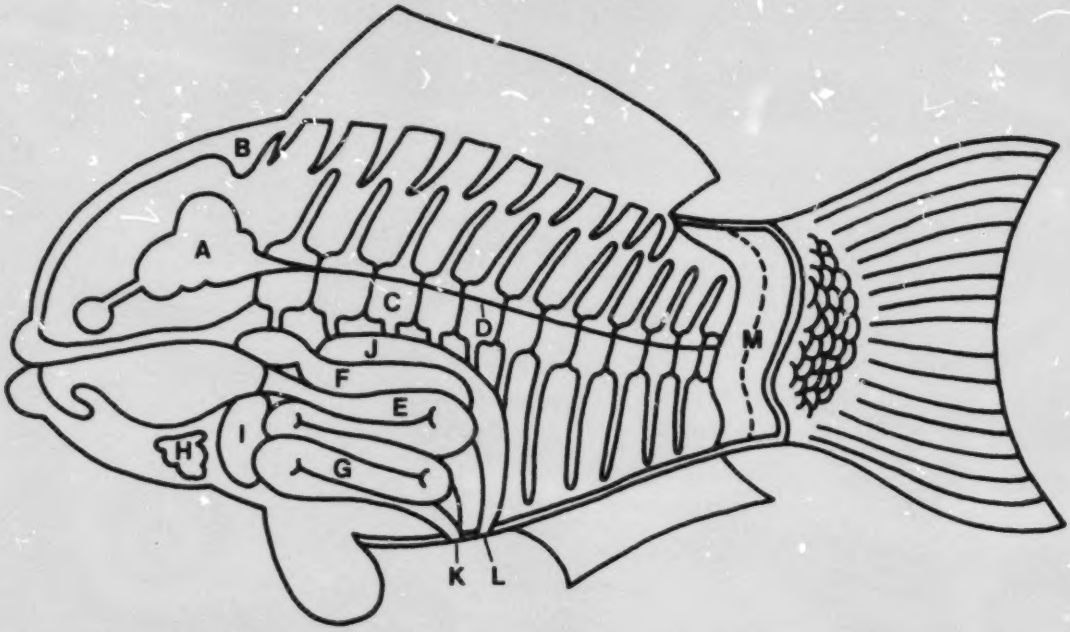
Fishes have, over long ages of time, adapted to many different environmental conditions. A major question today is: "Will fishes be able to adapt to relatively rapid changes in environmental conditions caused by humans?"



Fish- external structure



Fish- internal structure



A - Brain
B - Skull
C - Spinal Column
D - Spinal Nerve
E - Stomach
F - Swim Bladder
G - Intestine
H - Heart
I - Liver
J - Kidney
K - Anus
L - Urogenital Opening
M - Muscles

Vocabulary List

adaptation - (AD-up-TA-shun) - a change in an organism's structure or change in the functions of structures that produces better adjustment to the environment.

aquatic - (a-QWAT-ik) - living or growing in water.

backbone - the column of bones along the middle of the back.

cold-blooded - body temperature fluctuates with change in environmental temperature.

density - (DEN-sa-tee) - mass per unit volume.

dissolved oxygen (diz-ZOLVD OK-si-jen) - oxygen which has merged or mixed with water.

evolution (EV-o-LOO-shun) - a process of development of a species or organism from early primitive form to their present state, usually involving adaptations for better survival in their environment.

extinct (ik-STINKT) - no longer in existence.

fin - external wing-like structures, which are extensions of internal bones used by fish for swimming and balancing.

fish - any of a large group of cold-blooded animals living in water, and having backbones, gills for breathing, fins, and usually scales.

generation - (JEN-i-RAY-shun) - stages in the succession of descent - e.g., father and son are two generations.

gill - organ for breathing of most animals that live in water (fish, lobster, etc.)

habitat - (HAB-i-tat) - the physical place where an organism lives.

invertebrate - (in-VER-ta-brit) - having no backbone or spinal column.

jaw - either of the two bony parts that hold the teeth and framework of the mouth.

lateral line - (LAT-er-ul) - line of pores or indentations along the sides of fishes which allows them to orient themselves in water with respect to fishes, objects, and animals from the disturbances created in the water by their movement.

mutation - (mew-TA-shun) - a change in an inheritable characteristic of animals or plants.

natural selection (NACH-er-ul sa-LEK-shun) - process by which individuals with characteristics that help them adapt to environments tend to survive, and transmit their characteristics.

niche (nitch) - includes the physical space occupied by an organism as well as its functional role in the community.

operculum (oh-PERK-yoo-lum) - any of the various covering flaps in plants or animals, such as the bony covering protecting the gills of fishes.

phylum (FI-lum) - a classification group, animals grouped because of like/similar body structure.

protection - (pro-tek-shun) - means of shielding from injury, danger, loss.

scale - any of the thin, flat, overlapping, horny plates forming the outer covering of many fishes; protective.

scavenger - (SKAV-in-jer) - any animal that eats refuse or decaying material.

schooling - a large number of one kind of fish or aquatic animal swimming or feeding together.

sensory organs (SEN-ser-i) - body parts with the specific function of receiving and transmitting sense impressions.

skeleton - (SKEL-a-tin) - the hard framework of an animal for supporting the tissues and protecting the organs.

species - (SPE-shiz) - a single, distinct kind of plant or animal, having certain characteristics: a biological classification.

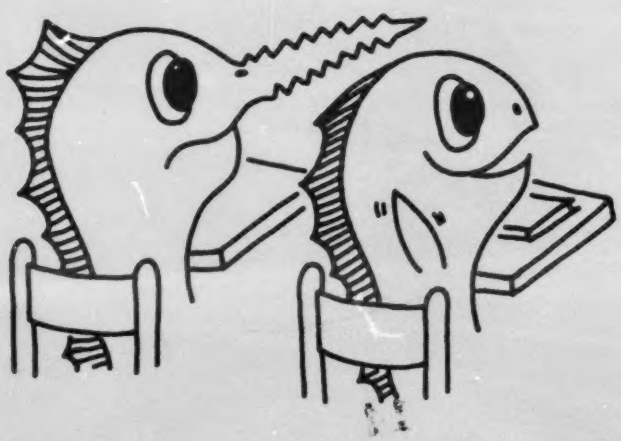
streamlined - having a shape designed to offer the least resistance in moving through air or liquids.

survival (ser-VIE-vul) - continued existence.

swim bladder - air bladder of a fish which makes it "almost weightless" aids in controlling a fish's position in the water. Sometimes called gas bladder or air bladder.

vertebrate - (VER-ta-brit) - having a backbone or spinal column (adj.); any of the large group of animals that have a backbone (noun).

warm blooded - having warm blood and a constant natural body heat.



*Skill Building

Observing and Inferring

The difference between an OBSERVATION and an INFERENCE is important for students to understand, but it does take practice.

An OBSERVATION is a description that is directly perceived through the five senses: seeing, hearing, touching, smelling, and tasting. An INFERENCE involves a judgement or conclusion based on one or more observations. It involves suggesting explanations or causes of events that have occurred.

With these definitions firmly in your mind, proceed with the following activities. Students will learn to observe and to distinguish observations from inferences in the process of doing activities below. Later they will demonstrate mastery of these skills as they do the worksheets, using fish. To instruct students in the process skills of observing and inferring begin by using familiar inanimate objects. Living organisms are often too distracting in this first phase.

Learning to Observe

A. Have students number a sheet of paper 1-25. Give each student a cookie and have them list as many observations as possible about the color, shape, texture and so on. **Do not define observations for them yet.**

B. With your students, develop a definition for observations consistent with the one stated above. With your students, review their lists and distinguish inferences from the observations they made. For example:

INFERENCES

It is a cookie
The brown specks are chocolate
They are made of sugar, flour, milk

OBSERVATIONS

they are brown and white
they are 1" across
there are specks in them
they taste sweet

Be sure to point out that observations can be made about the object as is, including measurements. Also the object may be manipulated to produce more observations (i.e. mixing, dissolving, dissecting ...). Supervise tasting carefully to be sure that students never taste anything harmful.

C. Divide the class into small groups. Provide each group with a box marked "R" containing rocks and a box marked "S" containing shells. Each box should have a lid securely taped on at all edges and have a 4" x 4" hole cut in the center of it. Students take turns placing their hand through the hold to feel the secret objects. The

*This "Skill-Building" section is from Sensing the Sea for Grades Two-Three, Ellen Odell-Fisher and Ronald N. Giese, VIMS/Sea Grant Education Series No. 23, 53 pp.

following questions should help stimulate observations.

How do they feel? Smell?
What did you use to find out?
Do the objects in the boxes feel the same? Different? How?
Are they rough or smooth?
Do they feel like anything that you have ever felt before?
What sounds can you make in each box?
What did you use to hear the sounds?
Which box contains things that are easier to hold on to? Why?
How many pieces can you count in each box?
Are the objects in each box the same size? Shape?
What shapes are they?
Are they the same on all sides?
Do they have edges?
Are the edges sharp?

D. Have your students place one object from each of the two boxes onto a table. Provide magnifying glasses and magnets for each group of students.

In what ways do they look the same? Different?
Which object is heavier?
How many colors can you find?
Are they both the same size? Shape?
Are the objects like anything that you have ever seen before? What?
Are they rough or smooth?
Which is rougher? Smoother?
Are they hard or soft?
Does anything happen when you place a magnet over the objects? What?

Learning to Infer

A. Students must make inferences about the objects used above to answer these questions.

What type of things do you think will stick to a magnet?
What objects from the boxes do you predict will float or sink?
What could animals use the objects for?
Where might you go to find each of these objects?
How might you find out answers to these questions?

B. Two Inferring Activities

1. Prepare the following. Place the same volume in each of six pint-size jars:

a. Water and 6 tbs salt (unstirred)
b. Water and 6 tbs. sugar (unstirred)
c. Water and 6 tbs. instant drink (unstirred)
d. Water
e. Water and a shell
f. Water and a rock

Tape black paper completely around the sides of the labeled jars so the children cannot see the contents.

Do any of these jars have the same thing inside?
Can we find out without looking? How?
Do they feel the same? Smell the same?
Do they taste the same? Different?
Do they make the same noise when shaken gently?
What is inside the jars?

Because students cannot be sure without removing the black paper, they can only infer what the contents might be.

2. Provide each small group with a baggie containing a small amount of vanilla instant breakfast. Have groups compete by listing their observations about the "mystery dust". Who can list the most? Students should also have magnets, rulers, magnifying glasses and other materials, perhaps water, for observing and manipulating the "dust". Now, based on their observations, what inferences can they make? What is the mystery dust? For example, your students may observe the following:

a. That the dust is made of white particles.
b. The particles are round.
c. The particles taste sweet.
d. The particles melt in water.

They may infer that the substance is something people could eat.

These are only a few of the many possible observations and inferences which students might make.

Fish- The Shaping of Life

WORKSHEET I

Grades 4-6

(Circle the correct answers to each question. Some questions have more than one correct answer.)

1. An organism with a backbone is called a

   (a) plant (b) vertebrate (c) gill

2. The fish is a good swimmer because it has

   (a) scales (b) blunt head (c) tapered body (d) broad tail (e) strong jaw

3. A fish steers with its

   (a) gills (b) blunt head (c) strong jaw (d) fins (e) scales

4. A fish breathes with its

   (a) lungs (b) nose (c) gills (d) swim bladder (e) scales

5. Fishes do not sink to the bottom or float on the top of the water because they have a

   (a) gill (b) swim bladder (c) tail (d) fins

6. The armor plates of early fish were something like today's fishes'

   (a) fins (b) gills (c) jaws (d) scales

7. Fishes taste things that are

   (a) salty (b) sweet (c) sour (d) bitter (e) oily

8. Fish feel motions of other fish through their

   (a) swim bladder (b) lateral line (c) gills (d) mouth

9. Natural selection favors those animals that are

   (a) best able to survive and reproduce
   (b) that are oldest
   (c) that can swim

10. Evolution

    (a) stopped 1 million years ago (b) is stopping now (c) will continue

Fish- Observations

WORKSHEET II

List all the observations you can make about the fish in front of you by:

1) observing as it is
2) making measurements
3) doing something to it

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
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37. _____
38. _____
39. _____
40. _____

Fish- Observations

WORKSHEET III

Check your observations on Worksheet II. Did you answer the following questions? If not, do so now.

1. Does it have a head? What does it look like?
2. Does it have a top and bottom? Front and back?
3. Does it have eyes? How many? Where are they located?
4. Does it have legs? How many? Where are they located? If not, what does it use to move? How many does it have and where?
5. What color is it? Is there more than one color? If so, what parts of the animal are what color?
6. How does it feel? Rough or smooth? If it is rough, describe what makes it rough. Is it rough in some places and smooth in others?
7. Does it have a mouth, teeth, ears, nose, hands? Some animals may have body parts that function the same as these but the parts will not look like ours. Describe each carefully.
8. Does it have an odor? Does it smell like anything you are familiar with? What?
9. If it is alive, how many ways does it move? Fast or slow? Does it eat? How?
10. Does it have any openings on its body? Where?
11. On a separate sheet of paper, draw your animal in as much detail as you can.

Fish- Inferring

WORKSHEET IV

From your observations, what do you think the answers are to the questions below? When you state what you think is true, based on your observations, you are making an INFERENCE.

1. Is it alive? How do you know?

_____

_____

_____

2. How does it get its food? What do you think it eats?

_____

_____

_____

3. Does it have a way of protecting itself? How?

_____

_____

_____

4. Does this animal have to hunt for its food?

_____

_____

_____

5. Where do you think this animal lives in nature? What body parts make that environment a good place for this animal to live? Why?

_____

_____

_____

Supplementary Activities

1. Some fishes have unusual names which present mental images of what the fish might look like. Have students draw a picture of one or more of the animals the way their name indicates they might look, then have students guess the names of each others' fish.

oyster toadfish	sargeant major
angelfish	nurse fish
boxfish	puffer
sea robin	croaker
parrotfish	seahorse
lookdown fish	filefish
pipefish	striped killifish
burrfish	grunt

   This may be done either by individuals being given an animal name, and the rest of the class guessing the name from the drawing or by listing animal names on the board and assigning an artist for each. The class then matches drawings and names. Individual students may enjoy looking these animals up in a reference book to see what they look like.

2. Tell how you think it feels to be a fish. What would make you happy? What would make you sad? What would you be afraid of? What would you worry about? Do you think fishes have these feelings? Do they help each other? Why?

3. Make a collage of fish pictures from magazines.

4. Discuss the evolution of a familiar animal such as a dog or horse. You may find this information in an encyclopedia, anthropology book, or a book about fossils.

5. Review new words by doing the crosswod puzzles (pages 20-23) and word search game (page 19).

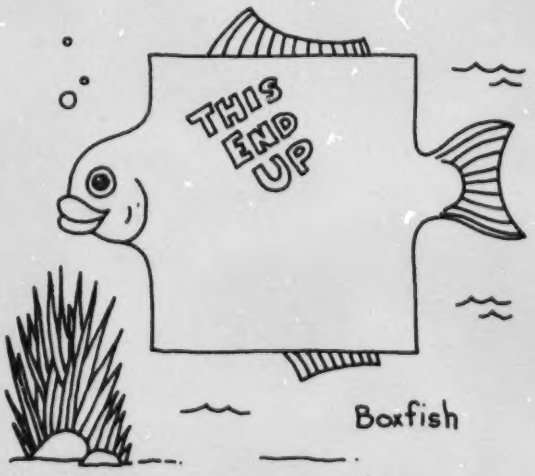
6. Individually or in small groups write or record a story about a fish. Be sure to describe where it lives, and what it eats. What kinds of adventures might a fish have?

   Or, as a class activity, one person starts the story by giving a sentence. The story builds as each classmate contributes a sentence.

7. Read at least one book about a fish or fishes.

8. Set up a marine or freshwater aquarium. This activity can greatly enhance many areas of your class work. Directions and instructional units for a marine aquarium are available from VIMS.

9. If your class has an aquarium, observe the animals in it. Keep a diary of what goes on in the aquarium every day. Where does each animal stay the most? Which is the most active? Are they all healthy? How can you tell?



Boxfish

10. Discuss how you should take care of your aquarium animals. What might make them sick? How can you try to make them better? Will any animals die? Why? If they do, what happens to them? How do you feel about it? Do animals die in the ocean? Why? What happens to them?

11. Count the animals in your aquarium. Does the number stay the same from week to week? Why or why not?

12. Draw and color three different fishes. List the differences. List the ways they are the same.

13. Make a variety of fish shapes on poster board, color and cut out. Make a mobile.

14. Use material found around your house or classroom to make the wildest imaginary fish that you can. Or, using trash, make "litter critter" fish.

15. Draw a fish on a big piece of poster board, color, label parts and cut it up like a jigsaw puzzle. Put it together or give it to some other students and let them try.

16. Draw some fish shapes and write math problems on them without the answers. Now cut out and attach a small piece of metal to each. Use a pencil, string, and magnet to make a pole, line and "hook". Lower the magnet into the fish bowl and catch a fish. The student may keep it if he/she can solve the math problem. If not, it must be thrown back. The one with the biggest catch wins.

    This activity can be used to drill or review sounds, or letter and number identification.

17. Go to a bait store. Ask the salesman what fish like what kinds of bait. Then go fishing! Try making some artificial bait. You can see what some look like at the bait store.

18. Visit a fish store or fish section of a supermarket. What kinds of fishes do they sell? Where did the fishes come from? Do you think they sell the same kinds of fishes in stores in your city as they do in Japan, Russia, or Brazil? Where can you find out?

19. Make a cookbook for preparing fish dishes. Ask your family and neighbors for their favorite recipes. Have a tasting party.

20. Make a collage of pictures of products made from fishes or fish parts.

21. Find out about air in water as a class activity. Fill a glass with cold tap water and examine it closely. Can you see air in it? Set the glass in a warm place. What forms along the sides of the glass? Where did they come from? What are they? They are bubbles of air that was dissolved in the water. The air came out of solution when the water warmed up.

22. Find out if fish need air. Observe guppies or goldfish in the aquarium or fish bowl. Are they swimming near the surface or in the middle? Determine their normal respiratory rate by counting how many times they open and close their gills in 15 seconds. Boil water. Cool it to room temperature. Then carefully transfer a fish from the aquarium to the cooled bowl of boiled water and observe its behavior. How does the fish behave differently in the cooled boiled water than in the aquarium water? (Because boiling has driven the dissolved oxygen from the water, the fish will swim to the surface for air.) Once this has been observed, quickly return the fish to the aerated aquarium. *From: Teacher's Manual and Source Book, The Children's Museum of Hartford, West Hartford, Conn., 98 pp.*

23. Find out how a swimbladder works. You will need a wide-mouth jar and a plastic medicine bottle with a tight-fitting cap. Fill the jar with water. Now cap the empty medicine bottle and drop it in the jar. It floats because it is filled with air. Remove the bottle and put a little water in it. How well does it float now? Keep adding water gradually until the bottle begins to sink to the bottom. At "neutral buoyancy" it will stay submerged without sinking or floating. Remember, though, fish do not sink by taking in water but rather by expelling air. Can anyone in the class think of a way to do this demonstration using a balloon? *From: Teacher's Manual and Source Book, The Children's Museum of Hartford, West Hartford, Conn., 98 pp.*

24. Write Haiku verse that tells your feelings about the ocean and/or marine life. Haiku is a form of Japanese unrhymed poetry consisting of 3 lines containing 5, 7, and 5 syllables respectively.

    Examples: Look at the Ocean
    See the waves, currents and tides
    Observe the movements.

    Sparkling light reflects
    Off the blue ocean water
    Setting spirits free.

25. Sing a song about fish. "Fishy" music may be obtained through VIMS-Sea Grant Marine Advisory Services.

26. Observe the movements of the different fishes in your aquarium. Can you imitate their body movements? Try.

27. Scientists sometimes determine the age of fish by examining the "rings" of a scale under a microscope. Observe a scale from a fish using a microscope. What does the scale look like magnified? Do some rings differ from each other? How? (Some rings may be farther apart or closer together. Some may be thick or thin. The thickness or distance between rings are indicators to the trained eye of certain seasonal growth.) Now examine a scale from a different fish or type of fish. Is it different? How? What other living organisms reveal their age by "rings" (trees, oysters)? Can you obtain some samples? Examine and research these organisms.

28. Place 3 or 4 zebra fish in your fresh water aquarium and observe their school-like swimming patterns. Ask your class how the fish know when to turn so that they stay in a group formation.

29. Make some saltwater as strong as possible. Let students taste the difference between fresh and saltwater. Put a wooden block in the freshwater and mark the water level on it as it floats. Then put it in saltwater. Note the water level on it as it floats.

30. Tie the fuselage of a toy plane on the end of a string and place it in front of a fan. Note its motion, then add wings. Note its motion: How does it change? How does this relate to a fishes' fins?

31. Find out something about how a lateral line works. Select two students to be observers, then divide the rest of the class into two groups. Out of the hearing of group one, explain to group two that they will form a line behind group one so each person in group one has someone behind him or her. Also tell group two that when the teachers says "tap" each one is to tap the person in front of him on the right shoulder.

    Now, have group one line up and close their eyes. Tell them that when someone taps them on the shoulder they are to open their eyes and look to see who has tapped them.

    Bring group two into position behind group one. Whisper to the observers that they are to watch carefully to see which way the students in group one turn when they are tapped on the shoulder. When the class is ready, say "tap". Ask the observers which way the students in group one turned. Ask the class why. Did they turn in unison? Why? Help your class relate this experience to the way fish move in a school.

Seek and Find

(Answers on page 31)

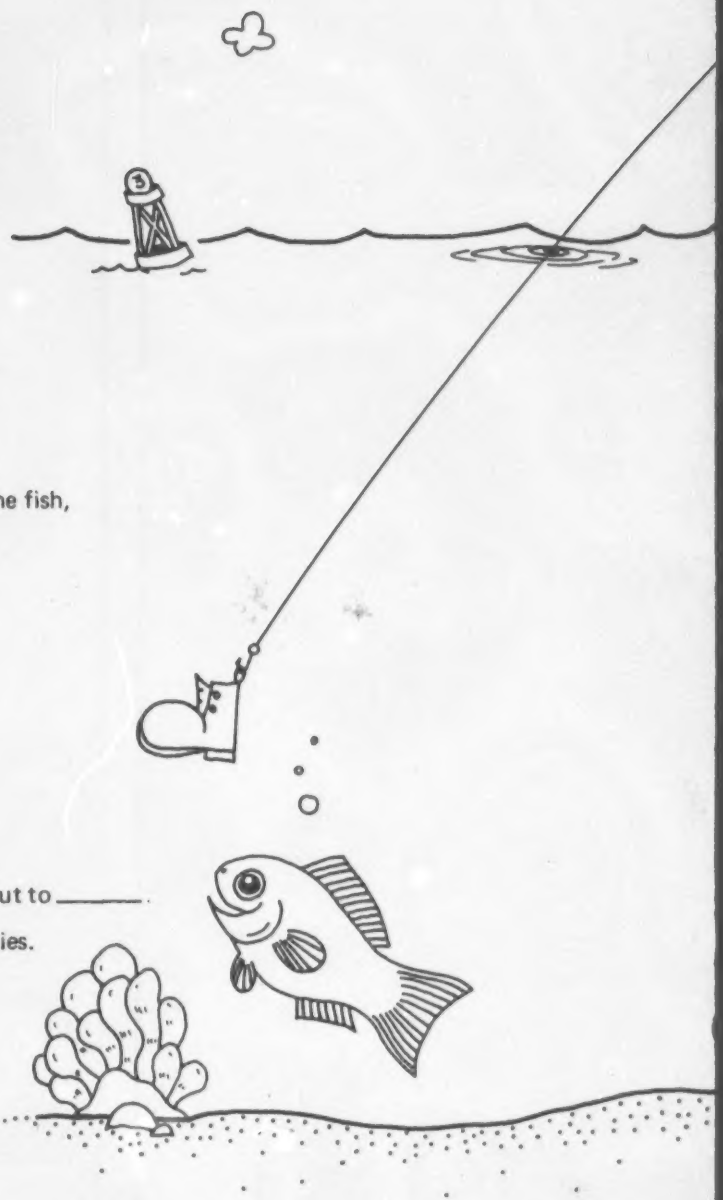
O X E A Y C A R T I L A G E
R L V T G Y O T A K U N I V
G A O N S H C A R F I A L O
A B L A H G I L L S D L S K
N C U S A B C K L M O F K A
I L T P R E D A T O R I E B
S A I T K D E T K R S N L T
M T O O B M L V M G A Z E I
S E N S O R Y E N A L L T D
S R N H R Q P R O N F A O N
A A F A O S T T P A A M N K
P L A S C A L E S M S M Q C
E L T I E U S B W A T A U I
C I S R A V I R I M J M A H
T N H R N W F A M A P A I D
O E X T I N C T B M F O W E
R X D S N X P E L V I C S B
A P Y G Y O T A A U S F T P
L O W G U Y E Z D T H L O T
X Y Z S E C A U D A L U P S
X O O S H N K H E R O G S A
Z P B K T E A T R O P P Q M

FISH
EVOLUTION
GILLS
PECTORAL
DORSAL
ANAL FIN
CAUDAL
SWIM BLADDER
SENSORY
GYOTAKU
PREDATOR
EXTINCT
VERTEBRATE
SHARK
OXYGEN
SCALES
ORGAN
ORGANISM
SKELETON
LATERAL LINE
CARTILAGE
JAW
PELVIC

Crossword Puzzle

Grades 2-3

(Answers on page 32)



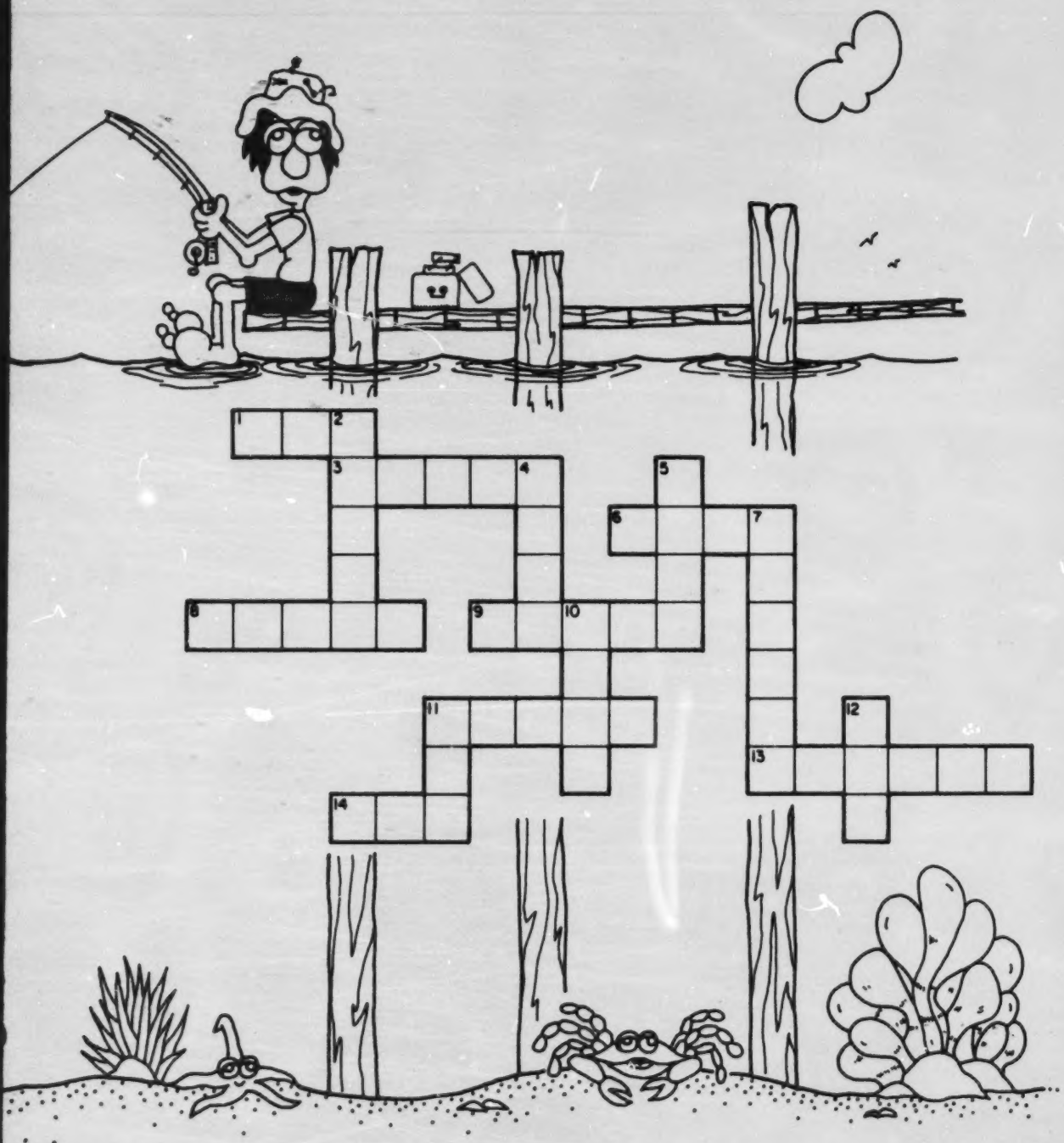
Across

1. Do all fishes have gills?
3. A fish must open this to eat.
6. Found on the top, bottom, sides and tail of the fish, _____ help fishes swim.
8. Fishes use these to breathe.
9. Fishes that bite have these.
11. All fishes live in this.
13. Most of these fishes have many sharp teeth.
14. All fishes do _____ look alike.

Down

2. A fish uses its nostrils (nose) not to breathe but to _____.
4. Coloring helps fishes _____ from their enemies.
5. Swimming animals with fins and scales.
7. Hard "plates" covering most fishes' bodies.
10. Most fisnes have these to see with.
12. Bones that form a fish's mouth.

11. Opposite of dry.



Crossword Puzzle

Grades 4-6

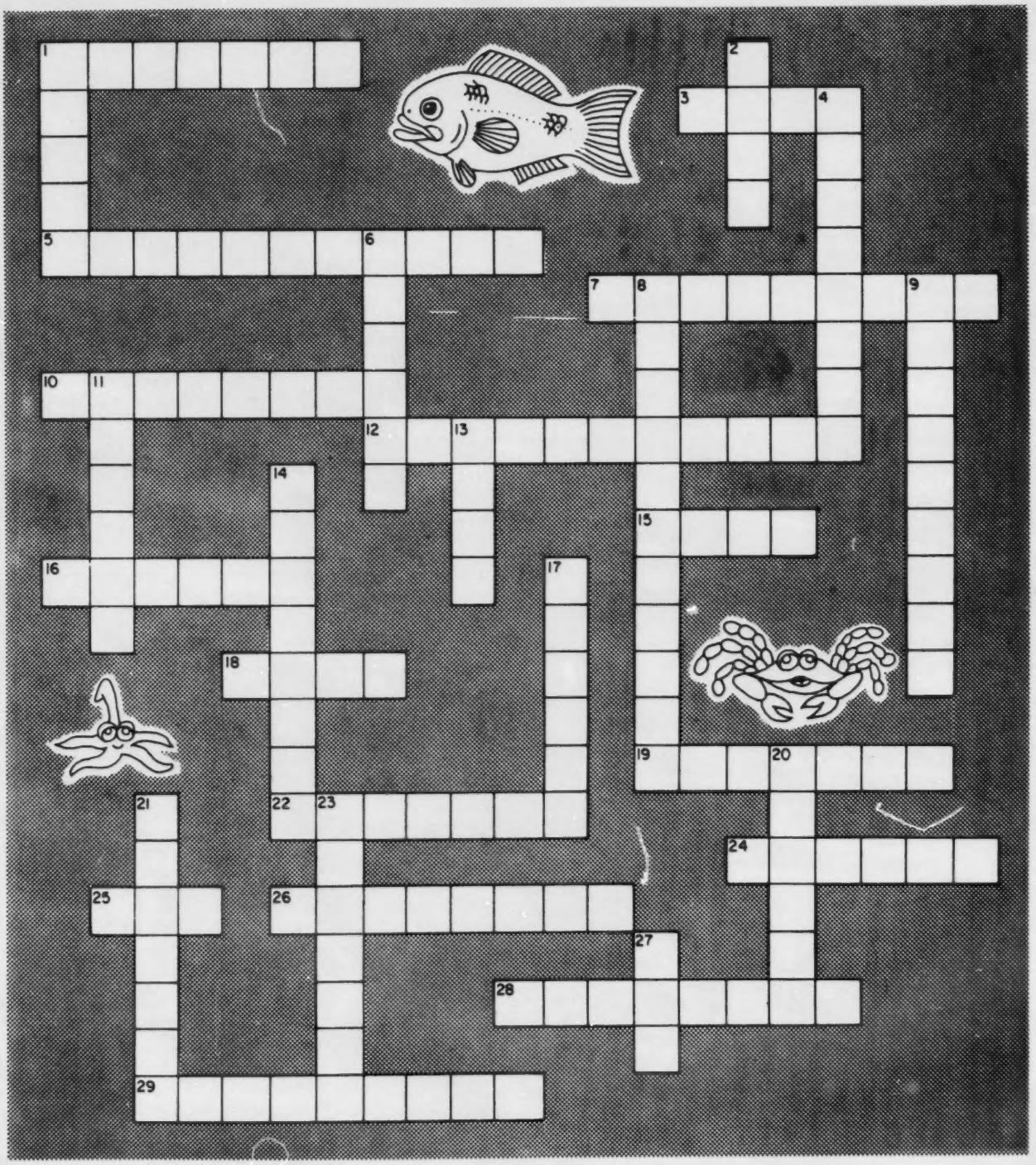
(Answers on page 33)

Across

1. Japanese for "fish printing".
3. Swimming animal with fins and scales.
5. This is found inside (internal) fishes. It keeps them from sinking (two words written as one).
7. Over long periods of time, (through generations) sometimes species will change a little. This is called _____.
10. Used for smelling, not breathing (fishes).
12. Changes of an organism which make it more fit for survival in its environment.
15. A spine, also called a _____ bone.
16. _____ fins are usually found on the lower surface of fishes, in front of the anal fin.
18. An animal whose internal temperature fluctuates with the temperature of its environment is _____ blooded.
19. Parts which pick up external stimulus - feel, see, smell, or taste, are called _____ organs.
22. Formed from pores which run down the side of the fish, the _____ lines allow fishes to feel movement in the water.
24. Tail fin, provides most forward movement in fishes.
25. Capillaries full of blood make gills look _____.
26. A change in an inheritable characteristic of a living organism.
28. A living being - plant or animal.
29. "Survival of the fittest" is the result of natural _____.

Down

1. Capillaries located here remove oxygen from the water.
2. Limbs used in movement of fishes.
4. Places where organisms live.
6. Fin located at "top", helps keep fish upright.
8. Animals with a spine.
9. Hard covering which protects gills.
11. A gas all living animals must have to survive.
13. The _____ fin, located on "belly" side (near tail), helps keep fish upright.
17. A large number of fish of the same kind swimming together.
20. Hard overlapping protection covering most fishes.
21. A distinct kind of animal or plant which do or may interbreed.
23. Adjective describes something living or growing in the water.
27. Bones which form mouth, well developed among predator fishes.

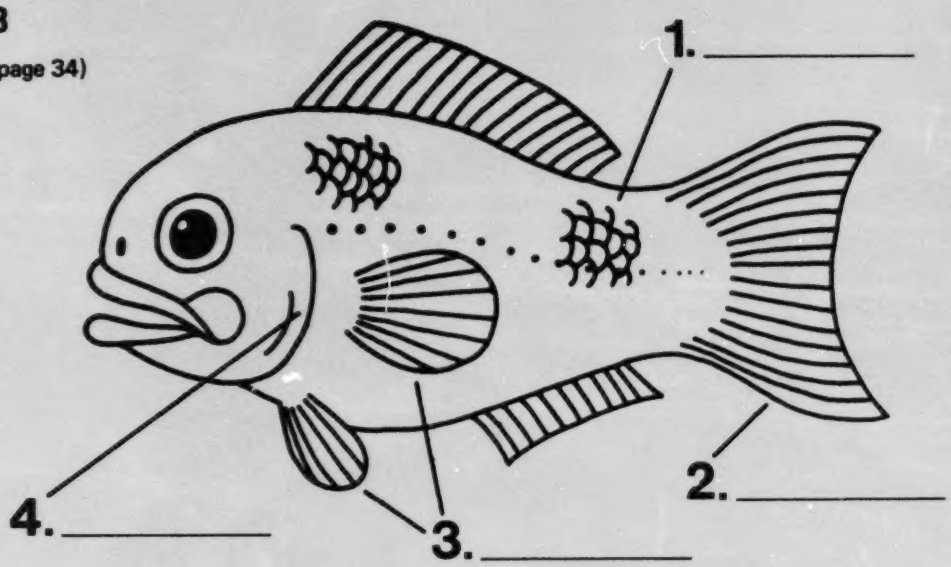


23

Post Test

Grades 2-3

(Answers on page 34)



LOOK AT THE PICTURE:

Write the name of the body part next to the number on the drawing.

Tail
Fins
Gills
Scales

What do body parts do? Write the name of the body part next to the thing it does.

5. For breathing _____ 6. For protecting body _____

7. and 8. For swimming _____ and _____

Circle the best answer

9. Fish swim in schools for:

fun learning protection

10. A fish's enemy probably attacks because it:

is hungry is mean is bad

*Note: If your students are not able to read this test easily, read the items aloud to them.

What do fish and people do?

Put a P in front of things that people do.
Put an F in front of things fishes do.
Put a P and an F in front of things that people and fishes both do.

11. _____ breathe

12. _____ move

13. _____ eat

14. _____ covered by scales

15. _____ have lungs

16. _____ have eyes

17. _____ covered by skin

18. _____ have gills

19. _____ school for learning

20. _____ school for protection

Make 6 observations about the object your teacher gives you. If you are in 3rd grade, list 3 inferences about the object

Observations

21. _____

22. _____

23. _____

24. _____

25. _____

26. _____

Inferences (3rd grade only)

1. _____

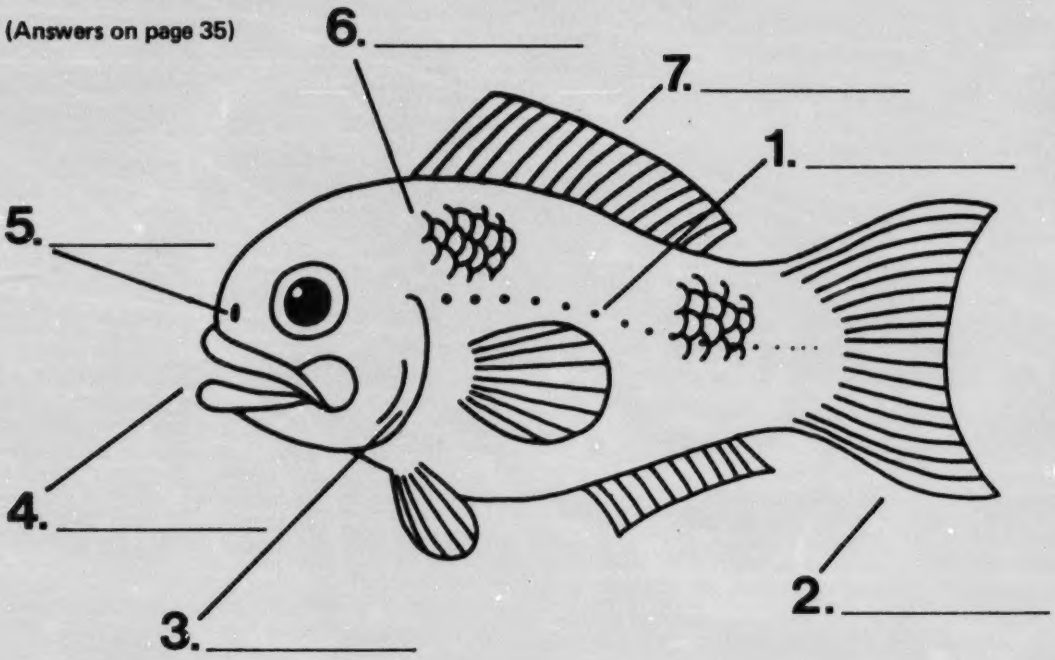
2. _____

3. _____

Post Test

Grades 4-6

(Answers on page 35)



Write the name of the body part next to the number on the drawing.

mouth	lateral line
scales	nostrils
tail fin	dorsal fin
gills	

Match the body part and what it does by writing the correct letter next to the function of the body part

8. _____	takes in water	A-mouth
9. _____	provides forward motion	B-tail
10. _____	senses motion in water	C-scales
11. _____	absorbs oxygen	D-gills
12. _____	protects fishes body	E-lateral line
13. _____	makes fish weightless in water	F-swim bladder

List 5 ways all fish are alike.

14. _____
15. _____
16. _____
17. _____
18. _____

List 5 ways in which fish may differ from each other.

19. _____
20. _____
21. _____
22. _____
23. _____

Make 6 observations about this sheet of paper.

24. _____
25. _____
26. _____
27. _____
28. _____
29. _____

Make 5 inferences about this sheet of paper.

30. _____
31. _____
32. _____
33. _____
34. _____

Sources and Materials

Most of the resource and audio-visual materials listed below are available from the VIMS-Sea Grant Marine Education Center. Copies of publications may be obtained in microfiche form for $.75 each, or paper copies for the cost of copying. Audio-visual materials may be borrowed from the Center.

In addition to the materials mentioned in this publication, the Center houses an extensive collection of educational materials useful for teaching marine topics. The Marine Education Materials System (MEMS) is multidisciplinary: maritime music, art, and literature are among the topics other than marine science found in MEMS.

To obtain materials for use with the lessons in the packet, or to find out more about other marine education materials, write or call:

Sea Grant Marine Advisory Services
Marine Education Center
Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

Telephone (804) 642-2111, Ext. 111

Student References

This list of good books written for children about fish is recommended in the *Teacher's Manual and Sourcebook,* by Carol E. Bower, (1975), of the Children's Museum of Hartford, Connecticut. Remember that some nationally available magazines contain articles that are excellent classroom resources.

Bindick, J. 1971. *Adaptations,* Watts. (EL)

Branley, F.M. 1971. *Oxygen Keeps You Alive,* T. Y. Crowell. (EL)

Burton, M. 1972. *The Life of Fishes,* Macdonald Educational. (INT)

Campbell, A. E. 1963. *Fins and Tails: A Story of Strange Fish,* Little, Brown, and Co. (EL)

Cartwright, S. 1973. *Water is Wet,* Coward, McCann and Geoghegan. (EL)

Frith, M. 1971. *Some of Us Walk, Some Fly, Some Swim,* Beginner Books, Random House. (EL)

Hylander, C. J. 1964. *Fishes and Their Ways,* MacMillan. (INT)

Kay, D. ND. *Child's Book of Fishes,* Maxton Publishers. (EL)

Lionni, L. 1974. *Fish is Fish,* Pinwheel Books. (EL)

Teacher References and References Used in Preparing this Packet

Publications

Boragine, R. 1976. *Tall Ships,* Marine Resources Dissemination Consortium, Massachusetts, 50 pp.

Bower, C. E. 1976. Teacher's Manual and Sourcebook (Parts 1, 2 and Sourcebook). The Children's Museum of Hartford, 950 Trout Brook Drive, West Hartford, Conn. 06119, 98 pp. ($3.00)

Marshall, N. B. 1971. *Explorations in the Life of Fishes,* Harvard University Press, Massachusetts. 204 pp.

Odell-Fisher, E. et al. 1978. *Sensing the Sea* for grades K-1, VIMS-Sea Grant, Gloucester Point, Virginia. 44 pp.

Odell-Fisher, E. et al. 1979. *Sensing the Sea* for grades 2-3, VIMS-Sea Grant, Gloucester Point, Virginia. 53 pp.

Reid, G. K. et al. ND. *Pond Life,* Golden Press, New York. (INT)

Spotte, S. 1973. *Marine Aquarium Keeping,* Wiley Interscience. 171 pp.

Wisner, T. 1974. "Fish", Naecker Bros. Lithographers, Md. 6 pp.

Webster's New World Dictionary of the American Language, 1967, The Southwestern Company, Tennessee. 202 pp.

Zim, H. S. et al. 1957. *Fishes,* Golden Press, New York. (INT)

Audio-Visual Materials

Connecticut Films, Inc. ND. *Swimmy.* 16 mm Movie. (EL)

Cousteau, J. 1974. "The Shaping of Life," Cousteau Group Inc. 35 mm Sound Filmstrip, Series Two: *The Life of Fishes.* (INT)

National Geographic Society. 1978. *What is a Fish.* Sound filmstrip. Learning Shelf Kit. (EL)

Paramount Communication. 1979. *Fish.* 16 mm movie. (EL)

Sea World, Inc. 1977. "Marine Vertebrates - Fishes," Guidances Associates. 35 mm Sound Filmstrip, Group Two. (EL, INT)

Aquarium Equipment Suppliers

Aquarium Stock Company
27 Murray Street
New York, NY 10007

Aquarium Systems, Inc.
1450 East 289 Street
Wickliffe, OH 44092

Coral Reef Exhibits
Box 2214 AMF Branch
Miami, FL 33159

Hawaiian Marine Imports
465 Town and Country Village
Houston, TX 77024

Norfolk Neptune Wholesalers
1922 Colonial Avenue
Norfolk, VA 23517

Ocean Odyssey
9444 Main Street
Fairfax, VA 22039

Pacific Marine Imports
5420 W. 104th Street
Los Angeles, CA 90045

World-Wide Aquarium Supply
2899 Norstrand Ave.
Brooklyn, NY 11229

Marine Life Suppliers

Carolina Biological Supply
2700 York Rd.
Burlington, NC 27215

General Biological Supply House
Turtox
8200 South Hoyne Ave.
Chicago, IL 60620

Gulf Specimen Co., Inc.
P.O. Box 237
Panacea, FL 32346

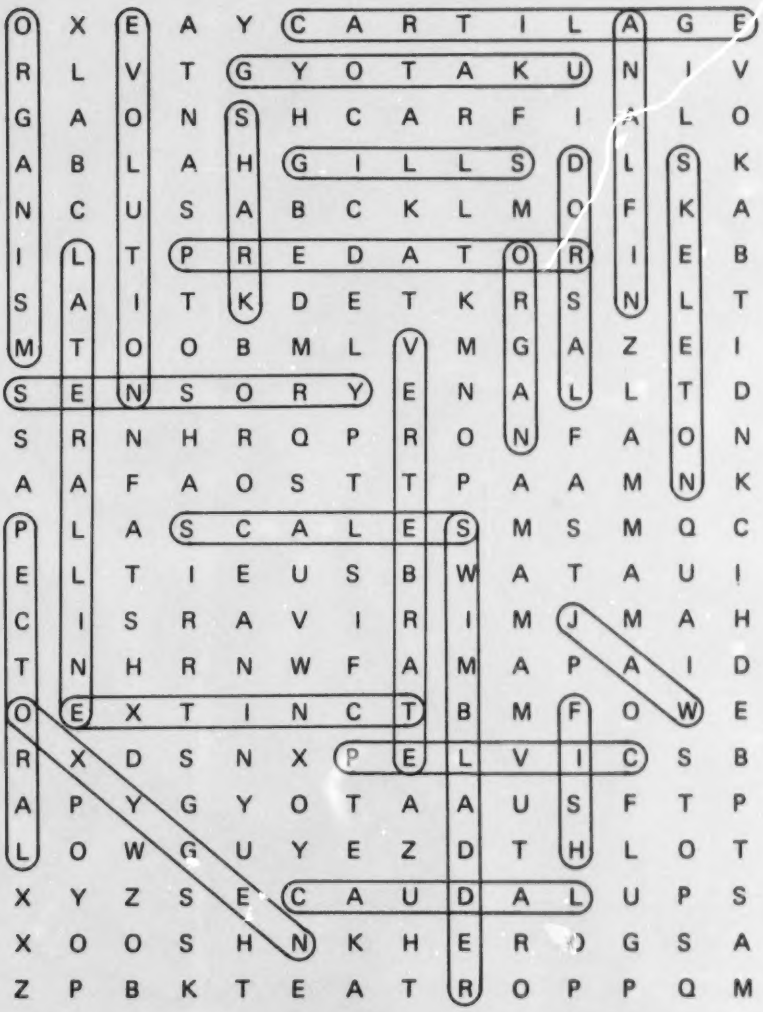
Marine Biological Laboratory
Woods Hole, MA 02543

Northeast Marine Specimens,
Co., Inc.
P.O. Box 1
Woods Hole, MA 02543

Local Resources

Seafood restaurants
Seafood processing plants
Pet stores and pet sections of department stores
Fish and aquarium stores
Local fishermen
Bait and tackle shops
Seafood counters in grocery stores
Marine science or biology departments of colleges or universities

Seek and Find Answers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G A O N S H C A R F I A L O
A B L A H G I L L S D L S K
N C U S A B C K L M O F K A
I L T P R E D A T O R I E B
S A I T K D E T K R S N L T
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P L A S C A L E S M S M Q C
E L T I E U S B W A T A U I
C I S R A V I R I M J M A H
T N H R N W F A M A P A I D
O E X T I N C T B M F O W E
R X D S N X P E L V I C S B
A P Y G Y O T A A U S F T P
L O W G U Y E Z D T H L O T
X Y Z S E C A U D A L U P S
X O O S H N K H E R O G S A
Z P B K T E A T R O P P Q M

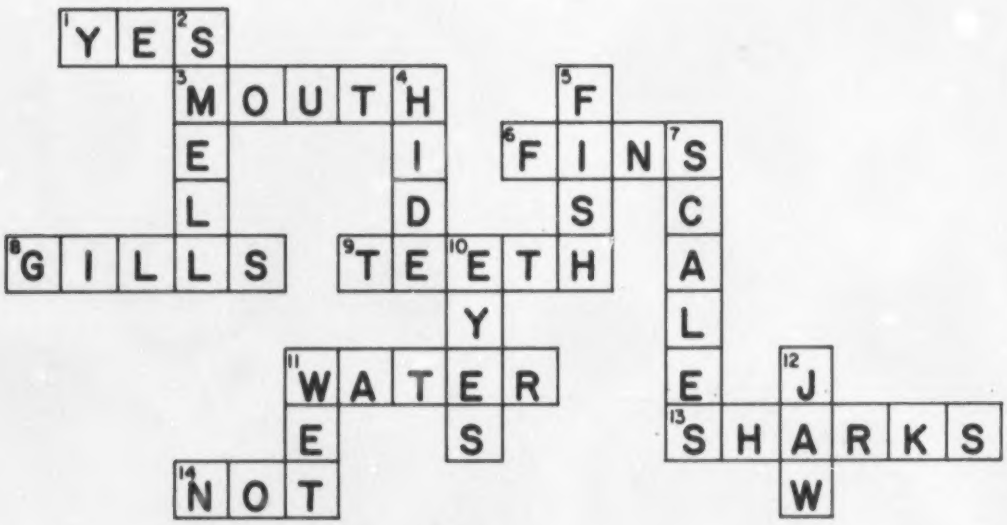
FISH
EVOLUTION
GILLS
PECTORAL
DORSAL
ANAL FIN
CAUDAL
SWIM BLADDER

SENSORY
GYOTAKU
PREDATOR
EXTINCT
VERTEBRATE
SHARK
OXYGEN
SCALES

ORGAN
ORGANISM
SKELETON
LATERAL LINE
CARTILAGE
JAW
PELVIC

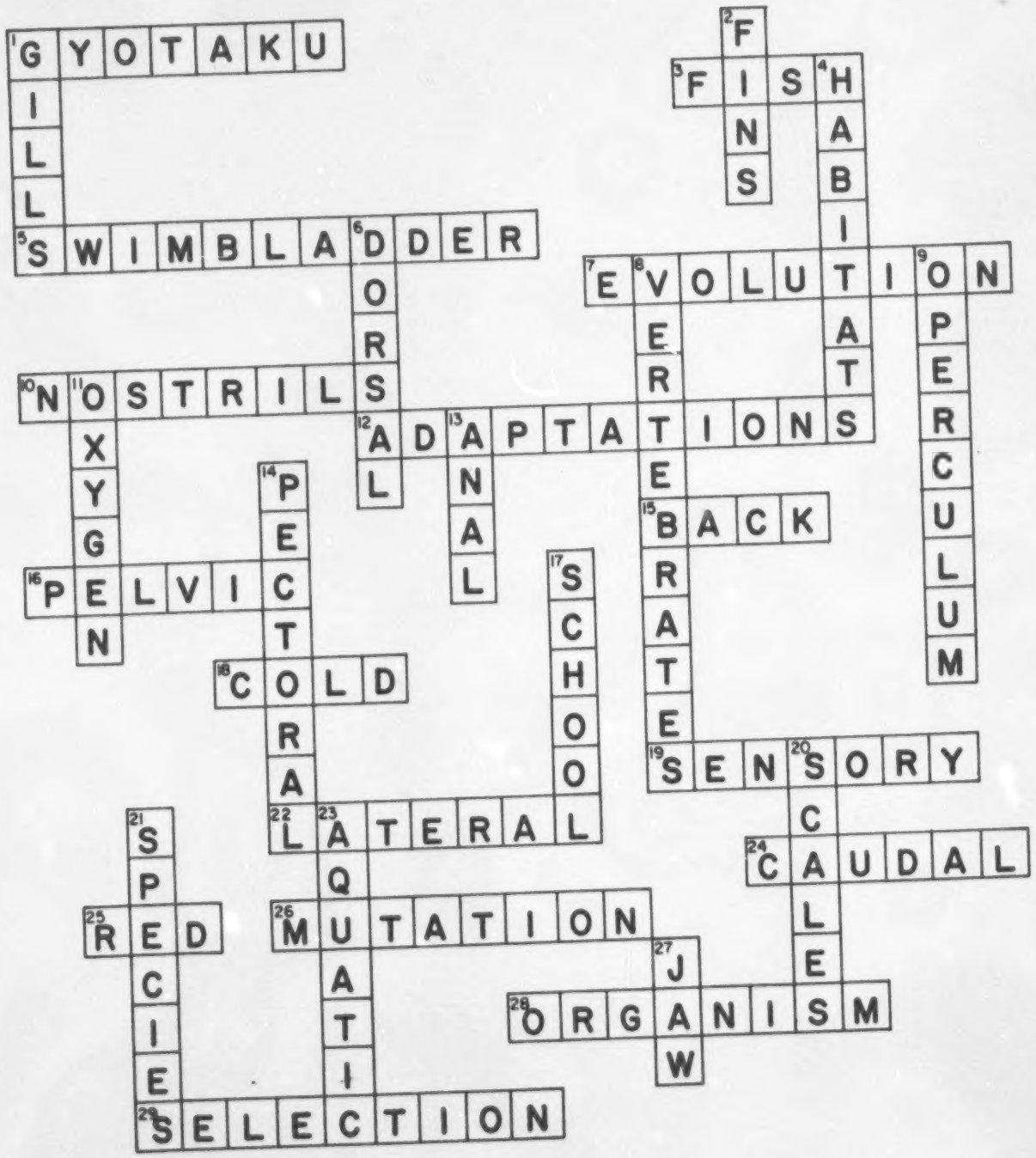
Crossword Puzzle Answers

Grades 2-3



Crossword Puzzle Answers

Grades 4-6



33

*Post Test Answers

Grades 2-3

1. SCALES
2. TAIL
3. FINS
4. GILLS
5. gills
6. scales
7. and 8. tail and fins
9. protection
10. is hungry
11. PF
12. PF
13. PF
14. F
15. P
16. PF
17. P
18. F
19. P
20. F

*21. through 26

* *Note to teacher: A variety of answers is acceptable as long as they are plausible and reasonable.*

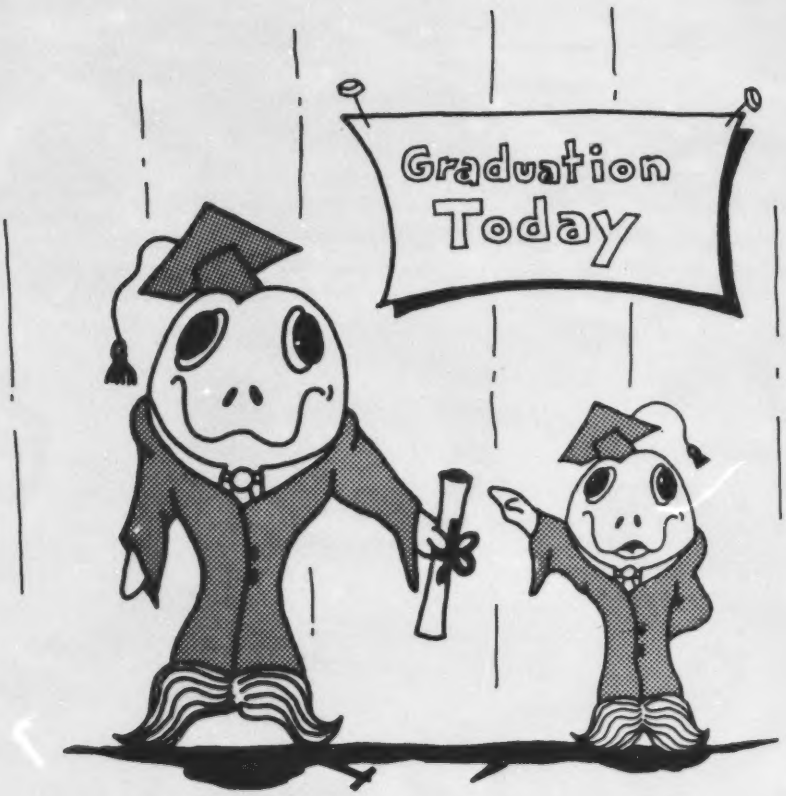
*Post Test Answers

Grades 4-6

1. Lateral Line
2. Tail Fin
3. Gills
4. Mouth
5. Nostrils
6. Scales
7. Dorsal Fin
8. A
9. B
10. E
11. D
12. C
13. F

* 14 through 34

* *Note to teacher: A variety of answers is acceptable as long as they are plausible and reasonable.*


Graduation
Today